UNCF Special Programs Corporation (UNCFSP)

FY 2011 Request for Proposals (RFP)

NASA Science and Technology Institute (NSTI) Research Clusters

Release Date: **February 14, 2011**
Proposals Due: **April 1, 2011**
Announcement of New Institutions: **May 1, 2011**

A program of UNCF Special Programs Corporation (UNCFSP)
Funded in part through a Cooperative Agreement with the
National Aeronautics and Space Administration (NASA)

Summary and Supplemental Information

NASA Science and Technology Institute (NSTI)

Inquiries
Technical and scientific questions about programs in this announcement may be directed to the UNCFSP Corporation staff:

Dr. Jacquelyn Madry-Taylor
Chief Research Officer
6402 Arlington Boulevard
Suite 600
Falls Church, VA 22042
Jacquelyn.taylor@uncfsp.org
703-205-6582

Inquiries regarding the submission of proposal materials may be addressed to:

Dr. Jacquelyn Madry-Taylor
UNCF Special Programs Corporation
6402 Arlington Blvd.
Suite 600
Falls Church, VA 22042
Telephone: (703) 205-6582
Fax: (703) 205-7645
Email: Jacquelyn.taylor@uncfsp.org

Release Date:	**February 14, 2011**
Proposals Due:	**April 1, 2011**
Selection Announcement:	**May 1, 2011**

Solicitation Availability: Go to www.uncfsp.org/NSTI-CLUSTERS

Selecting Official
The selecting official for this RFP is the University Affairs Manager at NASA Ames Research Center.

Funds Availability
Obligation to make an award is contingent upon the availability of appropriated Federal funds from which payment can be made and the receipt of proposals that NASA and UNCFSP determines are acceptable for award under this notice.

Number and Size of Award
UNCFSP expects to award three clusters (2 institutions per cluster) under this Notice. The estimated annual value of award to an institution is up to $100,000 per year for a total of $300,000 over a three year period of performance.

NASA Safety Policy
Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including contractor employees working on NASA award instruments), and (4) high-value equipment and property.

Proposal Submission
Institutions are instructed to submit one original online proposal with the signature of the Authorized Organization Representative (AOR). The complete proposal package must be uploaded into the UNCFSP system at www.uncfsp.org/NSTI-CLUSTERS no later than 4:00 p.m. Eastern Time, **April 1, 2011.** Late and/or incomplete proposals are subject to rejection without consideration.

On-line Application Package must include the following:

(Submit supplemental items as PDF documents.**)**

1. Uploaded application, with the required signatures and other required documents uploaded as PDFs:

   Curriculum Vitae: Your application must include a curriculum vitae/resume for each proposed Principal Investigator.

   Memorandum of Understanding (MOU): Each member institution of the cluster must sign and execute an MOU prior to submission of the official proposal.

Proposed Cluster Plan of Research: The proposed cluster research plan should include (a) Titled abstract (no more than 150 words); (b) Description of the proposed research, totaling no more than 20 single spaced uploaded pages. (The research and development plan should be presented with a clear scientific hypothesis or question(s) to be addressed by the proposed work, as well as the intended plan for integrating the research at the sponsoring NASA Center); (c) Timeline stating the proposed start and completion dates of specific research objectives; (d) Completed Budget form that includes the identities, curriculum vitae and areas of responsibility of cluster participants and (e) Budget Justification. The budget should represent the total cost for the project and include all members of the Cluster. Thus, it will be a Cluster Budget. Indicate which institution will receive the requested budget item. (See Template attached)

Endorsement: A letter of endorsement should accompany your application packet from the NASA Center scientist. Failure to include this letter will result in the application being rejected from competition.

Institution Eligibility and Certification: Each institution participating in the cluster must complete the Institution Eligibility and Certification form. The form should include a statement from the institution's AOR stating that they meet all criteria necessary to participate in the NSTI project and that they agree to participate and comply fully with the policies and procedures governing the grant and the cluster. **Form provided in appendix.**

Principal Investigator Eligibility: Each Principal Investigator and Co-Investigator participating as a part of the research project must complete and sign the Principal Investigator Eligibility form. The form should include a statement from the participant stating that they meet all criteria necessary to participate as a member of the research team and that they agree to comply fully with the policies and the procedures governing the grant and the cluster. **Form provided in appendix.**

2. Complete institution capability matrix. (This document is for viewing only and will be uploaded as a part of the application.)

Submit a complete online application package at **www.uncfsp.org/NSTI-CLUSTERS**. An application will be considered incomplete if the material provided is insufficient to allow an adequate review. Applications must be uploaded by **4:00 p.m. Eastern Time on April 1, 2011** to be included in the competition.

I. SCOPE OF THE PROGRAM

Introduction

The UNCF Special Programs Corporation (UNCFSP) in partnership with the National Aeronautics and Space Administration (NASA) solicits applications from accredited US Postsecondary Minority Institutions to become part of a research consortium funded through a cooperative agreement with NASA. Eligible accredited US Postsecondary Institutions are listed by the United States Department of Education at http://www.ed.gov/about/offices/list/orc/edlite-minorityinst-list-tab.html.

The purpose of the NASA Science and Technology Institute (NSTI) is to create a consortium of Minority Institutions (MIs) that will participate in cutting edge research in collaboration with NASA, other government agencies, private organizations, majority institutions as well as research and technical organizations through the establishment of Research and Development (R&D) partnerships. To this end UNCSP has developed a scalable program that is replicable throughout NASA and the STEM industry. The specific goals of the NSTI program are to develop a comprehensive plan that provides faculty and students with a year-round NASA research experience, and that increases the interest and number of academically talented students pursuing careers in STEM disciplines. Faculty and students' participation in the NASA Centers' research will further enhance the capacity of Minority Serving Institutions to conduct cutting-edge research. MIs selected through this competition will become members of a national research cluster. Thus, each participating institution in the cluster must develop a research team consisting of one faculty member who will serve as the Principal Investigator (PI) and have at least five undergraduate students or three undergraduate students and a graduate student participating in the research, and engage a NASA Center Scientist (provided by the selected NASA Center) who will serve as a mentor for the research project. Once the research team is determined, institutions must design a year-round institutional research plan that integrates faculty and students with one partner institution and a NASA Center's research initiatives. The research plans must be coordinated with and approved by the NASA Center Scientist to ensure that plans are responsive to the Research Areas of Support identified in this RFP. Research plans should be comprehensive and designed to offer faculty and students a rich research experience throughout the academic year. The plan should be designed to include, at a minimum, the following components: (1) a ten-week extended summer research experience at the NASA Center, (2) continued related research during the academic year at the home institutions and (3) middle school outreach activities at a local middle

schools designed to increase the interest of middle school students, middle school teachers and middle school staff in NASA STEM initiatives and disseminate research experiences to STEM classes. Additionally, research cluster will be required to share their research findings through participating in poster presentations, and/or attending STEM related conferences. UNCFSP sponsored professional development training will be provided to faculty and students. Research plans should have achievable outcomes that can be documented and provide faculty and students with meaningful academic and laboratory experiences. Student research must be approved and supervised by the faculty PI and should provide students the experience required for graduate level studies. A description of the research that students will conduct at the institution during the academic year should be provided along with plans for monitoring students' progress and their participation in related academic experiences. The value of being connected to the NSTI research program will provide students with an understanding or research requirements and protocols in academic and laboratory environments and prepare them for future work place research opportunities. The faculty researcher will work with their students to upload the student's information and application into the NASA One Stop Shopping Initiative (OSSI) Student On-Line Application for Recruiting Interns, Fellows, and Scholars (SOLAR) system, found at http://intern.nasa.gov/. Applications will include the name of the research cluster, the name of the affiliated NASA Center and host NASA lead scientist so these OSSI records can be clearly identified during the selection process.

The financial support for the NSTI Program comes from NASA's Office of Education with technical and management oversight provided by Ames Research Center. The NSTI program is administered by the UNCFSP. The UNCFSP NSTI program seeks to enhance training of a highly qualified workforce in the STEM disciplines needed to achieve NASA's scientific goals and will combine the talent and expertise of all Minority Institutions through research-based fellowships, internships and grants to advance scientific knowledge and to assist NASA in its various scientific and technical missions.

The NSTI will facilitate applied research and expose students and faculty from MIs to the very rich and diverse research environment that exist within NASA participating Centers. The NSTI is a national program and applicants are required to partner with scientists at the selected NASA Centers.

Background

In its *Education Strategic Coordination Framework*, NASA recognized that it needs to (1) strengthen NASA and the Nation's future workforce, (2) attract and retain students in STEM disciplines, and (3) engage Americans in NASA's mission. In 2006 NASA's Strategic Management Council approved this framework, which aligns the agency's total education portfolio with their strategic plan. This plan encompasses all of NASA's educational undertakings and governs its external relationships with all partners, to include minority institutions. Three outcomes serve to align all Agency education activities:

Outcome 1: Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals through a portfolio of investments.

Outcome 2: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

Budget Terms and Conditions

Representatives from each proposed Cluster institution should collectively develop the budget according to the needs of the Cluster Project. A budget template is provided in the Appendix. Each institution can receive up to $100,000 per year for a total Cluster value of $200,000, renewable for up to two additional years, based upon satisfactory performance and **availability of funds**. This amount includes year-round and summer stipends of $10,000 per student for five undergraduate students or for undergraduate students and one graduate student who will serve as mentor; provided the institution has a graduate program. The funds may be used to support student stipends and other required expenses, to include housing and transportation to and from the proposed NASA Center. Additionally, the remaining $50,000 is available to support Institution Indirect Cost Rate (10% Cap); faculty salary/release time; faculty housing and transportation to and from the proposed NASA Center; and research project supplies and equipment. The selected students must continue in the project for a minimum of one complete academic year inclusive of summer research at the NASA Center. All research activities must be related to the research themes of the respective participating NASA Centers and should be focused on the research theme.

Funding for the institution will be initially for one year and may be renewed for no more than two additional years, contingent upon satisfactory progress (as reflected in research progress, and recommendation by the NASA Lead Scientist) and the availability of funds. Each institution is encouraged to work with the UNCFSP to attract additional grants and/or contracts to support and sustain their research activities at their home institution.

Eligibility Requirements

It is anticipated that a minimum of three research clusters will be established by this announcement and cluster applications must be submitted by the minority institution. Eligibility requirements are as follows:

- Institutions participating in Clusters must be designated as a Minority Institution by the U.S. Department of Education.
- Faculty researchers must be U.S. Citizens and must be full-time, tenure-track or tenured faculty at a Minority Institution.
- Faculty researchers must hold a PhD, ScD, or equivalent in a STEM field.
- Faculty researchers must be recommended by Department Chair or Dean and President.
- All students must be U.S. citizens.

II. PROGRAMMATIC INFORMATION

Benefits to Participating Minority Institutions

The program offers its participants numerous opportunities among which are to conduct new research and to obtain additional contracts to sustain research activities; access to NASA's internal and informal networks; acquisition/expansion of knowledge of NASA's technical and scientific needs; sharing information about respective applicant MI capabilities and technologies; opportunities to compete for research awards, interface with high-level NASA and other government officials; participation in **R&D** programs from NASA and related science and technology communities to learn about innovative scientific and engineering research methods; participation in discussions on the pedagogy of STEM disciplines; enhancement of research and management capabilities of Minority Serving Institutions in science and technology areas of interest including the entire aerospace industry; engage in professional development geared toward managerial development, and research marketing skills; gain opportunities to network and establish long lasting relationships with STEM colleagues throughout the country; enhance undergraduate

and graduate research and to build entrepreneurial, scholarly publication and intellectual property protection skills.

Evaluation and Student Tracking

Evaluation and student tracking will be important components of the proposal. The evaluation plan must include formative evaluations providing immediate feedback on development activities and a summative evaluation providing information on overall outcomes. The plan should include an outline of the data to be collected; the methods by which it will be collected, stored, and analyzed; and the timetables for collection and reporting.

Research Overview

NASA supports basic and applied research through it mission directorates. The fundamental questions and goals for NASA's research activities are given in a series of Strategic Plans and Science Roadmaps. These documents can be accessed at http://science.hq.nasa.gov/strategy/.

Interested institutions are advised to pay close attention to two key criteria for proposal evaluation and selection: (1) relevance of the proposed investigation to the NASA mission as described in 2006 NASA Strategic Plan and (2) the potential for development of market-based technologies. Therefore, faculty should ensure that the intended research is clearly relevant to NASA research programs and/or missions and/or strategic objectives. Programmatic factors may also affect selection (for example, see specific priorities listed below). The proposal should present a well-defined problem and justification of its scientific significance, as well as a detailed approach for its solution and a clear description of potential market application.

Research Areas of Support

All applications to NSTI must address the goals and objectives of one of the research themes outlined below. The applicant shall have the primary responsibility of defining the proposed research to be conducted through NSTI, with input from the NASA Lead Scientist at the NASA Center at which the respective research is occurring. The Lead Scientists and locations are as follows:

a. Ames Research Center, Moffett Field, CA -Dr. Meyya Meyyappan

b. Dryden Research Center, Edwards, CA- Dr. Lance Richards

c. Goddard Space Flight Center (Science), Greenbelt, MD-Dr. Lucy McFadden

Goddard Space Flight Center, (AETD), Greenbelt, MD-Dr. Lucy McFadden

d. Marshall Space Flight Center, Redstone, Arsenal, AL- Dr. Benjamin G. Penn

e. Johnson Space Center, Houston, TX- Dr Don Henninger

Johnson Space Center, Houston, TX- Dr. Paul B. Niles

Johnson Space Center, Houston, TX- Dr. Millard Reschke

NASA Center Information

The following NASA Center information is provided to assist applicants in determining the best research area that fits the research interest of the institution applying.

Project A:
NASA Center: Ames Research Center
Location: Moffett Field, CA
Lead Scientists: Dr. Meyya Meyyappan, Dr. Jessica Koehne
Contact Information: m.meyyappan@nasa.gov Tel: (650) 604-2616

Research Thematic Description-

Description:

The Nanotechnology Group at NASA Ames has been focusing on nanomaterial growth and characterization for more than ten years for applications in chemical sensors, biosensors, energy production and storage devices, detectors and instrumentation. Successful material development has led to extensive in-house work on device fabrication and testing in the above domains. Chemical sensors have NASA mission needs in cosmochemistry for detection of various gases and organic volatiles in other planets, earth observation and leak detection in crew vehicles. Energy generation and storage devices are critical for missions since conventional energy sources are not available to the mission planners and therefore our focus has been on improving solar cell efficiency, new sources such as piezoelectric and thermoelectric power generation and storage devices such as supercapacitors.

For the purpose of this NSTI project, a detailed description of our biosensor work is provided below. Mission needs for this endeavor include water quality monitoring, life detection in other planets, point-of-care (POC) diagnostics in crew health monitoring etc. Biosensor development is a very active field across the world with the goals of high sensitivity, rapid analysis, minimal pre- and post-processing, and low cost devices. The gold standard to date is optical (fluorescence) based techniques and some commercial devices are available. We believe that electronic detection

techniques can surpass the detection limits offered by the state of the art while being amenable for integration with microfluidics.

Our technology involves a nanoelectrode array (NEA) with individual carbon nanofiber (CNF) electrodes. Details of the technology can be found in J. Koehne et al. Clinical Chemistry Vol 50(10), pp 1886-1893(2004) and J. Koehne et al, Journal of Materials Chemistry, Vol 14(4), pp 676-684(2004).
The CNFs are about 50 nm in diameter and probe molecules for a target of interest are attached to the tip of the CNFs. Following probe-target hybridization, electrical or electrochemical approaches can be used for signal generation. Probes can be DNA, RNA, antibodies or aptamers.

Description of research:
The current major focus is biosensor development for point-of-care lab-on-a-chip. Crew health monitoring involves the ability to measure and monitor Na, K, Ca, glucose, chloride, BUN creatinine, white blood cell count, traponin, bilirubin, PaO_2, $PaCO_2$, pH, and urine analysis among various other requirements. The critical criteria include high sensitivity, reliability, minimal pre- and post-processing needs, compact, low power needs and amenability for multiplexing. There is no such system currently available in the market. We believe that CNF NEA system is suitable for development to meet this need. Various tasks can be grouped into two major categories: (1) electrode development and integration with microfluidics and (2) probe development for each target, and demonstration of the biosensing efficacy. The former task involves disciplines of material science, process technology, microfluidics, and MEMS while the latter requires knowledge of biology, biochemistry and chemistry.
In the next five years, we foresee developing a working system for point-of-care diagnostics. Specific tasks ahead to accomplish the goal include:

- Novel electrode processing technology to isolate individual CNF electrodes, for example, use of paralyne as dieletric instead of SiO_2.
- Technologies enabling multiplexing capability
- DNA, RNA, antibody, aptamer probes for various point-of-care needs constitute the most critical element in the entire program.
- Biosensing demonstration: probe-target hybridization and signal generation

Key Words: Biosensing, point-of-care diagnostics, lab-on-a-chip, crew health monitoring, low cost diagnostics

Project B:
NASA Center: Dryden Flight Research Center
Location: Edwards and Palmdale, CA
Lead Scientist: Dr. Lance Richards
Contact Information: lance.richards-1@nasa.gov Tel: (661) 276-3562

Research Thematic Description

Description:

NASA Dryden is requesting the development of a NASA Science and Technology Institute (NSTI) project to support the development of an advanced sensor laboratory at NASA Dryden's partner for Aerospace Education, Research, and Operations (AERO), the AERO Institute. Advanced sensor technology, measurement systems, and avionics systems development is a cross-cutting requirement to support NASA across its mission directorates: exploration systems, science, aeronautics, and space operations. Advanced avionics and flight system verification and validation are needed to support data acquisition, real-time data processing, control, monitoring and telemetry for atmospheric and spacecraft development and mission operational support. Research and development is needed in sensor and measurement technologies to validate performance in representative laboratory and flight test environments. Research and technology development is being solicited for every stage throughout the measurement cycle from sensor design and development, sensor calibration and error correction methods, installation methods, characterization of measurement uncertainties, measurement robustness, integrity, reliability, accuracy, especially for increasing bandwidth requirements for spacecraft in the future.

Accurate and high performance sensors are a fundamental requirement that supports every technical discipline in space and aeronautics. Advanced sensor research and technology development is requested in the following areas:

Advanced Sensors for Structural Health Monitoring & On-board Nondestructive Evaluation (NDE) - NASA Dryden is a world leader in the development of fiber Bragg systems for Structural Health Monitoring. Research is requested specifically to address the advanced concepts pertaining to fiber Bragg grating sensor and system technology, such as signal noise and degradation due to

polarization, birefringence, and chirping effects. In space systems, fiber optics reduces electromagnetic interference with other spacecraft components and has potential as lightweight, reliable sensor systems. Research and technology development is required also for the data transmission, acquisition, recording, processing, feature extraction, data mining, data visualization, correlation pre-flight predictions and real-time automated on-board decision making. Sensor development for other structural health and non-destructive evaluation that supports flight research is also needed; e.g., microelectromechanical systems (MEMS), nanotechnology, piezoelectric devices and wireless networks.

Advanced Sensors for Flight Validation of Advanced Aerodynamic Concepts - To accelerate innovative and potentially game-changing technologies, flight research is used to investigate and validate technologies in representative flight environments early in design and development cycles. Representative flight environments for aerospace vehicles include high-altitude, low density, and high-velocity for ascent and entry type aerodynamics. Measurements from advanced aerodynamics and propulsion sensors are used to support the development of simulation models, creation of aerodynamic databases and the understanding of atmospheric processes.

Advanced Sensors and Methodologies for Structural Dynamics & Control – Future aircraft and spacecraft will use advanced materials, may depart from traditional construction, and employ lightweight, highly flexible structures. Lightweight materials are especially important for launch systems in order to reduce the propellant cost to orbit and increase payload capacity. Lightweight and highly multiplexed sensor and sensor arrays are required as input to flight control systems to adequately control these lightweight structures to increase efficiency and maintain safe structural operation. In addition, techniques for active and/or adaptive control of structural resonances and static shape control will need to be advanced.

Advanced Control Concepts, Sensor Integration & Intelligent Mission Management - Sensor technology improvement for intelligent real-time decision-making based on payload or mission driven objectives needs to be developed. Human/autonomous system interfaces for spatial situational awareness, mission management and multi-platform coordination are also needed. Advance sensors also will be required for vehicles with unique planforms or missions to address issues such as integrated aero-propulsion, distributed effector and sensor arrays, structural feedback, real-time performance/mission optimization, and highly flexible structures. Integration of the flight control system with other systems on- and off-board the vehicle will be required to

leverage advances in vehicle health monitoring, data-mining, and multi-vehicle control. Data-mining and multi-vehicle control is especially critical with aerospace vehicles because of the limited access to and on-site repair of a vehicle's systems.

Hot Structures and Thermal Protection Systems - High temperature sensors and advanced measurement systems are required to support Hot Structures and Thermal Protection Systems. Novel sensors, technologies and validation are needed for high-temperature strain, heat flux, and temperature measurements. Structural test and measurement techniques for combined thermal-mechanical static and dynamic loads testing are of high interest.

Modeling & Simulation - Additionally, advanced sensors are required to support advanced simulation and modeling capabilities. Such capabilities require the data collection and analysis to support simulation development and software verification and validation. NASA is interested in extending the capabilities of current simulation systems by developing a comprehensive set of tools in the form of software suites that would allow for real-time structural and aerodynamics simulation and advanced data collecting.

Test Range Systems - Real-time data processing, control, monitoring, and telemetry for experimentation and ascent, entry and in-space systems are also required to maintain cross-cutting capability with test range systems.

Key Words: Advanced sensors, advanced aerodynamic concepts, simulations and modeling, hot structures and thermal protections, structural health monitoring

Project C

NASA Center: Goddard Space Flight Center
Location: Goddard, MD
Lead Scientist: Dr. Lucy McFadden
Contact Information: lucyann.a.mcfadden@nasa.gov Tel. (301) 614-6941

Research Thematic Descriptions for the Science Division

Description:

Research Area 1

Astrophysics Science Division (ASD)

The Astrophysics Science Division is on one of the largest and most diverse astrophysical organizations in the world, with activities spanning a broad range of topics in theory, observation,

and mission and technology development. Scientific research is carried out over the entire electromagnetic spectrum—from gamma rays to radio wavelengths—as well as particle physics and gravitational radiation. Members of ASD also provide the scientific operations for two orbiting astrophysics missions— XTE and Swift, as well as the Science Support Center for the Fermi Gamma-ray Space Telescope. A number of key technologies for future missions are also under development in the Division, including X-ray mirrors, space-based interferometry, high-contrast imaging techniques to search for exoplanets, and new detectors operating at gamma-ray, X-ray, ultraviolet, infrared, and radio wavelengths. ASD has a strong suborbital research program, with four balloon programs and three sounding rocket programs at present. The Division supports research in the astronomical community through the High Energy Astrophysics Science Archive Research Center (HEASARC), which now also contains Cosmic Microwave Background data, as well as support services for observers using the Fermi, Suzaku, Integral, XMM-Newton, GALEX, RXTE, WMAP, and Swift missions. Finally, ASD has a strong Education and Public Outreach program, to convey the exciting discoveries from NASA missions to school teachers, students, and the public.

Astrophysics Science. The Astrophysics Science Division conducts a broad program of research in astronomy, astrophysics, and fundamental physics. Individual investigations address issues such as the nature of dark matter and dark energy, which planets outside our solar system may harbor life, and the nature of space, time, and matter at the edges of black holes.

Observing photons, particles, and gravitational waves enables researchers to probe astrophysical objects and processes. Researchers develop theoretical models, design experiments and hardware to test theories, interpret and evaluate the data, archive and disseminate the data, provide expert user support to the scientific community, and publish conclusions drawn from research. The Division also conducts education and public outreach programs about its projects and missions.

Key words: astronomy, astrophysics, fundamental physics, dark matter, dark energy, solar system, black holes, photons, gravitational waves, gamma ray, high energy astrophysics, astroparticle, x-ray astrophysics, gravitational astrophysics, observational cosmology, exoplanets and stellar astrophysics

Names of Scientists: William Oegerle, Director (Dark Energy), Joan Centrella Associate Director (Gravitational Astrophysics) , Neil Gehrels (Astroparticle Physics Lab Chief), Robert Petre (X-Ray Astrophysics Lab Chief), Tucker Stebbins (Gravitational Astrophysics Lab, Chief), Jonathan Gardner (Observational Cosmology Lab Chief), Jennifer Wiseman (Exoplanets and Stellar Astrophysics Lab, Chief)

Research Area 2

Earth Science Division (ESD)

The ESD's Mission is to improve life on Earth and to enable space exploration through the use of space-based observations. To study the planet from the unique perspective of space, ESD develops and operates remote-sensing satellites and instruments. ESD's goals are to:

- Advance understanding of the Earth System through exploration from the vantage point of space.
- Improve predictions of the Earth system through measurements and models.
- Provide leadership in Earth system science and technology including the development of new instruments, measurement missions, and models.
- Establish partnerships to promote Earth science.
- Enhance the nation's scientific and technological literacy.

ESD conducts a broad theoretical and experimental research program to answer the following questions:

- How does the Earth work?
- How is the Earth changing?
- How does our changing environment affect life on 'Earth?

The science focus areas include: atmospheric aerosols, atmospheric chemistry, atmospheric water cycle, carbon cycle and ecosystems, climate modeling and analysis, oceanography, polar climate change, terrestrial water cycle, and weather and short-term climate.

Earth Science. The Earth Sciences Division at NASA Goddard Space Flight Center plans, organizes, evaluates, and implements a broad program of research on our planet's natural systems and processes. Major focus areas include climate change, severe weather, the atmosphere, the oceans, sea ice and glaciers, and the land surface.

To study the planet from the unique perspective of space, the Earth Science Division develops and operates remote-sensing satellites and instruments. We analyze observational data from these spacecraft and make it available to the world's scientists. Our Education and Public Outreach efforts raise public awareness of the the Division's research and its benefits to society.

Key words: climate change, severe weather, the atmosphere, the oceans, sea ice and glaciers, land surface, remote sensing, carbon cycle, ecosystems, global modeling, mesoscale atmospheric processes, climate and radiation, atmospheric chemistry and dynamics, hydrospheric and biospheric sciences, cryospheric sciences, hydrological sciences, terrestrial information systems

Names of Scientists: Peter Hildebrande, Director, Dorothy Zukor, Associate Director, James Hansen (Goddard Institute for Space Studies), William K. Lau, (Laboratory for Atmospheres Chief), David Adamec (Hydrospheric and Biospheric Sciences Lab Chief)

Research Area 3

Heliophysics Science Division (HSD)

The Heliophysics Science Division's Mission is to explore the Sun's interior and atmosphere, discover the origins of its temporal variability, understand its influence over the Earth and the other planets, and determine the nature of the interaction between the heliosphere and the local interstellar medium.

The Heliophysics Science Division conducts research on the Sun, its extended solar-system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere. Division research also encompasses geospace -- Earth's uppermost atmosphere, the ionosphere, and the magnetosphere -- and the changing environmental conditions throughout the coupled heliosphere (solar system weather).

Scientists in the Heliophysics Science Division develop models, spacecraft missions and instruments, and systems to manage and disseminate heliophysical data. They interpret and evaluate data gathered from instruments, draw comparisons with computer simulations and theoretical models, and publish the results. The Division also conducts education and public outreach programs to communicate the excitement and social value of NASA heliophysics.

Major activities of HSD include:

- Leading science investigations involving flight hardware, theory, modeling, and data analysis that will answer the strategic questions posed in the Heliophysics Roadmap.

- Leading the development of new solar and space physics mission concepts and supporting their implementation as Project Scientists.
- Providing access to measurements from the Heliophysics Great Observatory (HGO) through our Science Information Systems.
- Communicating science results to the public and inspiring the next generation of scientists and explorers.

The HSD's strategic goals are to:

- Open the frontier to space environment prediction;
- Understand the nature of our home in space;
- Safeguard the journey of exploration.

Heliophysics Science. The Heliophysics Science Division conducts research on the Sun, its extended solar-system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere. Division research also encompasses geospace -- Earth's uppermost atmosphere, the ionosphere, and the magnetosphere -- and the changing environmental conditions throughout the coupled heliosphere (solar system weather).

Scientists in the Heliophysics Science Division develop models, spacecraft missions and instruments, and systems to manage and disseminate heliophysical data. They interpret and evaluate data gathered from instruments, draw comparisons with computer simulations and theoretical models, and publish the results. The Division also conducts education and public outreach programs to communicate the excitement and social value of NASA heliophysics.

Key words: Sun, solar system environment, geospace heliosphere, ionosphere, thermosphere, magnetosphere, solar system weather, interstellar gas, solar physics, geospace physics, space weather, solar disturbances, solar wind, magnetic reconnection, solar cycle, corona, solar wind plasma, interplanetary medium, UV radiation, magnetic dynamos

Names of Scientists: James Slavin, Director, Douglas Rabin, Associate Director Solar Physics, Adam Szabo (Heliospheric Physics Lab Chief), Melvyn Goldstein (Geospace Physics Lab Chief), Michael Hesse (Space Weather Laboratory, Chief)

Research Area 4

Solar System Exploration Division (SSED)

SSED's Mission is to provide scientific expertise and leadership to support GSFC projects and to achieve NASA's strategic goals in the exploration of the solar system and beyond. The Solar System Exploration Division provides leadership in conceiving, defining, and implementing NASA's programs that advance our understanding of the solar system and the capability to explore. The Division plans, organizes, evaluates, and implements a broad program of theoretical and experimental research to explore the solar system and to study the formation and evolution of planetary systems. To do this, the Division conducts a broad program of innovative research that spans across astrochemistry, planetary systems, planetary geodynamics, space geodesy, planetary magnetospheres, comparative planetary studies, investigations of Earth as a planet, solar system data systems, and instrument development. The Division also engages in cross-cutting research in lunar exploration, astrobiology, and Mars exploration.

Major activities of the Division include:

- Developing theoretical models of the origin and structure of solar systems and their objects, and the processes that alter them.
- Designing experimental approaches and hardware to test these theories in the laboratory and on ground-based, aircraft, and space platforms.
- Collecting, interpreting, and evaluating data gathered from these experiments, and publishing conclusions based on experimental and theoretical research.
- Archiving and disseminating these data, providing expert user support to the community, and undertaking education and public outreach programs centered on our science missions and services.

Solar System Exploration. The Solar System Exploration Division conducts theoretical and experimental research to explore the solar system and understand the formation and evolution of planetary systems. Laboratories within the division investigate areas as diverse as astrochemistry, planetary atmospheres, extrasolar planetary systems, planetary geodynamics, space geodesy, and comparative planetary studies.

Division scientists develop theoretical models of how planetary systems form and evolve and design experiments and hardware to test them. They collect, interpret, and evaluate experimental data and publish conclusions based on this research. The Division archives and disseminates the data, provides expert user support, and undertakes education and public outreach programs about the Division's science missions and services.

Key words: astrochemistry, planetary atmospheres, extrasolar planetary systems, planetary geodynamics, space geodesy, comparative planetary studies, laser remote sensing, planetary magnetospheres, atmospheric science

Names of Scientists: Anne Kinney, Director, Amy Simon-Miller, Associate Director, Jason Dworkin (Astrochemistry Lab), Chief, Reggie Hudson (Planetary Systems Laboratory Chief), Pamela Millar (Laser Remote Sensing Lab Chief), Steven Curtis (Planetary Magnetospheres Lab Chief), Herbert Frey (Planetary Geodynamics Lab Chief), Paul Mahaffy (Atmospheric Experiments Lab Chief).

Research Thematic Description for Engineering and Technology

The Applied Engineering and Technology Directorate (AETD) at NASA/GSFC embraces the overall theme of Advanced Technology and Engineering for Tomorrow's Exploration (ATETE)

Research Area 5:

Technologies and Systems to support NASA development, demonstration, testing, and flight performance with reduced operational risks during mission lifetimes.

1. **NSTI CubeSats.** A CubeSat is a type of miniaturized satellite used for space research, normally a 10 cm cube with a mass of up to 1 kg (1U CubeSat). Larger 3U (10X10X30cm) and 6U (10X20X30cm) CubeSat systems are currently being investigated. Required research would develop components, technologies and systems to support NASA technology demonstration and risk reduction efforts. Research include addressing of miniature power, pointing, communication, command/telemetry, structure, deployable sub-systems and/or integration of such components into complete off-the-shelf "CubeSat bus" systems, minimizing "bus" weight/power/volume/cost and maximizing available "payloads resources for future space application.
2. **High performance multicore processing for advanced automation and science data processing on spacecraft**. The required research is in the area of software frameworks and architectures to utilize these platforms. The required research includes efficient inter-core communications, software partitioning, fault detection, isolation & recovery, memory management, core power management, scheduling algorithms, and software frameworks be done to enable a transition to these newer platforms.
3. **Mixed Signal and Mixed Technology Modeling.** VHDL-AMS is an IEEE standard hardware description language that can simulate mixed signal and mixed technology

systems. The required research would assist GSFC by modeling complete instrument systems and their components. Several design trade-offs by this modeling effort are sought. and these results would inform the specific hardware implementation or approach. Intellectual property (IP) should be maintained for use by subsequent flight instruments. An electronically accessible intellectual property design database that can be reused should be developed.

4. **Lasers and Electro-Optics.** GSFC seeks development of new concepts and optical technologies for future generation laser ranging, remote sensing laser instruments and optical communications systems for space applications. Specific topics include solid- state lasers, fiber and waveguide optical amplifier systems, optical parametric amplifiers, tunable infrared semiconductor lasers and single-photon detector arrays; and space qualification, testing, reliability analysis of diode laser arrays.
5. **Development & Application of Super-Resolution Synthetic Aperture Radar (SAR) Data Processing Techniques.** Synthetic aperture radar (SAR) is an airborne or spaceborne coherent microwave remote sensing system that can provide high-resolution images of an observed area, night and day and nearly independent of the weather conditions. The required research applies mathematical tools such as parametric spectral estimation techniques, wavelet theory for enhancing performances of SAR data processing algorithms.

Names of Engineers: Thomas Flatley, Charles Wildermann, Robyn King, Michael Krainak, Manohar Deshpande, and Wesley Powell

Research Area 6:

Engineering Advancements for NASA Exploration

1. **Analog Synthesis of Mixed Signal ASICS.** Digital synthesis opened up the path for the direct synthesis/realization of hardware through a *hardware description language (VHDL and Verilog*. The required research is for the proposer to work with the external commercial mixed signal ASIC companies to translate their "analog/mixed signal primitives" into a VHDL-AMS format such that analog and mixed signal components can be simulated and realized in hardware.
2. **Instrument Detector Focal Plane Electronics.** The required work creates and maintains the focal plane electronics IP. This IP would be highly generic but parameterizable to meet the specific requirements of each imaging flight instrument. There is an option of

translating these "generic" focal planes electronic design into radiation hardened Structured ASICS.

3. **Advanced nanocomposites for performance-enhanced spaceflight materials.** Research is sought to develop advanced nanocomposities for flight application and to establish a strong position to evaluate promising materials developed by outside researchers
4. **Miniaturized devices for solid, liquid, and gas handling for future planetary science analytical instruments.** Research is sought to address gaps that exist in this area to complement lots of activities to look at how to autonomously handle sample in robotic Solar System exploration missions. Additional research is sought for support in testing such components or subsystems for relevant future mission applications
5. **Radiation Enablement.** Research is sought for development of radiation hardness assurance guidelines for commercial off the shelf (COTS) component assemblies and the development of test environment requirements for emerging technologies viewed as enabling to NASA.

Names of Engineers: Anthony Sanders, Stephanie Getty, Robyn King, Alvin Yew, and Wesley Powell

Project D
NASA Center: Marshall Space Flight Center
Location: Redstone Arsenal, AL
Lead Scientist: Dr. Benjamin G. Penn
Chief Technologist: Dr. Andrew S. Keyes
Contact Information: Benjamin.g.penndr@nasa.gov Tel. (256)544-7809
Andrew.keyes@nasa.gov Tel: (256) 544-8038

Research Thematic Description

A significant overall theme of research conducted at the MSFC involves research and development in composites, and sensors for monitoring structural health of those composites, particularly in extreme space environments. Extreme environments may include high and low temperature extremes, radiation environments, etc. One specific example of "extreme environments" includes cryogenic structures where R&D at the MSFC focuses on Composite Overwrapped Pressure Vessels (COPVs) including their fabrication, testing, nondestructive evaluation (NDE), and structural health monitoring (SHM) using Fiber Bragg Grating (FBG) and other sensors. A high temperature example of composite development and sensing capability, also cross-cutting, is in composite/sensor development for electric motor casings. Less cross-cutting, but important for improved J2X engine specific impulse (Isp), high temperature ceramic/composite nozzle extension

development continues to be a MSFC technology development. For the example of COPV, there is existing collaboration with the MSFC including other NASA Centers, universities, and companies. Some of the current loosely organized university collaborations would be significantly strengthened by formalizing a science and technology research project. In any case, there is a range of exploration requirements at the MSFC requiring development of composites for mass advantage and sensors for SHM. The following are some of the relevant discipline breakdowns with respect to potential participating institutions.

- Fabrication of Composite Structures for Cryogenic and High Temperature Applications
  - Develop and test potential candidate composite materials for COPVs:
    - Provide COPV test beds
    - Perform hydrostatic testing of COPVs
  - Improve the mechanical properties of COPVs such as fracture toughness, impact tolerance, burst strength, and resistance to crack initiation and growth at cryogenic temperatures.
  - Fabricate and test ceramic composites for high temperature applications such as the J2X engine and electric motor casings.
  - For all composite structures, measure the mechanical properties of materials exposed to temperature extremes and other space environments by MSFC researchers.
  - For all composite structures, participate in the testing of SHM sensors.

Key words: composites, carbon/epoxy, carbon/phenolic, carbon-carbon composites, ionic liquid epoxides, polymer epoxy resin, density, resin content, compressive strength, shear strength, thermal conductivity, coefficient of thermal expansion (CTE), tensile strength.

- Structural Health Monitoring (SHM) Sensors
  - Develop and test advanced sensors for the SHM of cryogenic and high temperature composites.
  - Sensors will be tested on composites fabricated by potential MSFC partner.
  - Collaborate with MSFC to evaluate composite properties

- Nondestructive Evaluation (NDE) of Composite Materials
  - Perform NDE measurements on impact, and otherwise, damaged composite materials used to determine the effectiveness of SHM sensors

- Assess the effectiveness of various NDE techniques for determining composite damage in collaboration with the MSFC NDE group. Some NDE techniques for consideration are:
  - Visual inspection
  - Cryogenic fluid penetrant inspection
  - Optical/radiographic inspection
  - Eddy current inspection
  - Ultrasonic inspection
  - Thermographic inspection

Key words: piezoelectric constants, strain levels, PMN-PT, PZT, piezoelectric sensors, piezoelectric materials, structural health monitoring, piezoelectric response, temperature dependence, Curie temperature, nondestructive evaluation, nondestructive techniques

Research Area 1: This research area involves the fabrication of composites and improvement of their mechanical properties. An important aspect of this area will be the measurements of mechanical properties of a range of composite structures, such as for COPVs, electric motor casings, etc., exposed to ambient and the extreme environments that come with space exploration.

Names of Scientists: Tom Delay/EM 42, tom.delay@nasa.gov (256) 544-1131
Jan Rogers/EM50 jan.r.rogers@nasa.gov (256) 544-1081

Research Area 2: This research area includes the structural health monitoring (SHM) and nondestructive evaluation (NDE) of composite structures using Fiber Bragg Grating (FBG) sensors, comparisons of a range of piezoelectric materials (e.g., PMN-PT vs PZT; commonly used as SHM sensors), and other sensoring/NDE techniques.

Names of Scientists: Curtis Banks/EV43, curtis.e.banks@nasa.gov 256 544-4437
James Walker/EM20 james.k.walker@nasa.gov (256) 544-5064

Anticipated Research over the next five years:

Existing capabilities at the MSFC include fabrication, testing, nondestructive evaluation (NDE), structural health monitoring, and extreme space environmental exposure of a range of materials. Over the next 5 years, MSFC will work to expand these capabilities to improve on low-temperature storage efficiencies, cryogenic fluid management, and transfer of cryogenic fuels as requirements to better facilitate the enabling of on-orbit refueling, zero boil-off in fuel depots, and long-duration inner/inter-planetary missions where radiation damage can be a significant issue for polymer

composites; promising materials of considerable mass advantage. The success of space exploration, to a considerable extent, is dependent on advanced cryogenic technologies, which includes efficient composite overwrapped pressure vessels. There are also challenging composite development requirements on the high temperature end of extreme space environments to be encountered for future exploration, such as composite development for electric motor casings and other needs. For example, there is a need to develop carbon/carbon composites for J2X nozzle extensions, e.g., to improve on specific impulse and thrust while maintaining mass advantage, and this work is anticipated to proceed over the next five years as well. Beyond the immediate vehicle environment, the space environments are varied, and are divided into four general categories: Low Earth Orbit (LEO), Geosynchronous Orbit (GEO), deep space, and the lunar surface. The environmental constituents for each of these typical environments are different and require different tests to qualify the devices for use. These test facilities reside at the MSFC. For example, in LEO, atomic oxygen (AO) is a significant concern, while AO is not a concern in other environments. The nature of space environmental testing will depend on the mission requirements. Environmental conditions at different locations in space are specified in the following chart:

Environment	LEO	GEO	Deep Space	Lunar
Radiation dose electrons/protons (rads/yr in Si for 0.025mm Al)	10^3 / 10^5	10^8 / 10^5	10^5	10^5
Solar Wind (std) (nA/m^2 of electrons or protons)	650	~650	1/r^2 variation	~650
Solar VUV/UV radiation at 1AU (w/m^2)	0.1082/108.2	0.1082/108.2	1/r^2 variation	1/r^2 variation
AO at 600km & Solar Max(atoms/m^2-yr)	10^{25}	Not Applicable	Not Applicable	Not Applicable
Thermal Environment Extremes	T_{min} < -95C T_{max} > +110C	T_{min} < -175C T_{max} > +80C	Location Dependent	–150 °C to 150 °C

Environmental conditions for LEO, GEO, Deep Space, and the lunar surface.

Key Words: Cryogenic fluids, cryogenic storage, composites, composite overwrapped pressure vessels, pressure vessels, carbon/epoxy, carbon/phenolic, ionic liquid epoxides, polymer-epoxy resin, space environments, radiation, atomic oxygen, zero boil-off, thermal environment extremes, carbon-carbon composites, nozzle extensions, solar wind, orbital debris, micro-meteoroid impact, composite damage, sensors, structural health monitoring, nondestructive evaluation, polymer fabrication, fiber Bragg gratings, piezoelectric sensors.

Project E

NASA Center: Johnson Space Center
Location: Houston, TX

Research Description 1
Lead Scientists: Dr. Paul B. Niles
Contact Information: paul.b.niles@nasa.gov (281) 483-7860

The long term goal of our research is to understand the environment and characteristics of aqueous environments on Mars and how that informs bigger questions about the origin of life and history of water in the inner solar system. More specifically we are performing a set of research projects to better understand the origin of sediments on Mars. This question can be addressed by a broad range of research methods including geomorphologic analysis, laboratory mineral synthesis experiments, laboratory weathering experiments, analysis of martian meteorites, climate modeling, geochemical modeling, and analysis of data returned from landed spacecraft. Due to a broad range of methods employed, this research project can accommodate investigators with a variety of specialties within the earth science and planetary fields.

Specific examples of studies that are planned in the near future include: regional geologic studies of Mars focusing on identifying geomorphologic characteristics that can help distinguish the source of sedimentary layers and the method of their emplacement; Laboratory experiments focused on formation of hematite and sulfate minerals at low temperatures; Climate modeling to understand areas of high precipitation on Mars and effects of obliquity; Nature of martian atmospheric aerosols and their inclusion in martian snow or rain as a mechanism for delivery of SO_2 to the surface; and Basaltic weathering experiments at ultra-low temperatures well below 0^o C.

Key Words: Mars, geochemistry, weathering, sulfate, carbonates, ice, glaciers

Research Description 2:
Lead Scientist: Dr. Millard Reschke
Contact Information: millard.f.reschke@nasa.gov (281) 483-7210

JSC is the home of the NASA Human Research (HRP) Program Office. Our Space Life Sciences organization manages bother medical operations and research activities in various space physiology disciplines, habitability and environmental sciences, behavioral health and exploration medical care:

- Bone & Mineral
- Cardiovascular
- Exercise Physiology
- EVA Physiology

- Neurosciences
- Nutritional Biochemistry
- Biomechanics
- Space Medicine

Detailed research activities can be viewed on the HRP and Division websites:

http://hrp.jsc.nasa.gov/

http://humanresearch.jsc.nasa.gov/files/hrp-47065_reva_IRP.pdf

http://humanresearchroadmap.nasa.gov

http://sk.jsc.nasa.gov/

http://sf.jsc.nasa.gov/

http://sd.jsc.nasa.gov/

Our research is aligned with the HRP knowledge gaps and risks outlined in the human research roadmap. NASA JSC scientists compete with the extramural community for grants through the NASA research Announcements that are independently peer reviewed.

Key Words: Bone and Minerals, nutritional biochemistry, space medicine, biomechanics

Research Description 3:
Lead Scientist: Dr. Don Henninger
Contact Information: donald.l.henninger@nasa.gov (281) 483-5034

In the Engineering Directorate, Crew and Thermal Systems Division the overall themes of research are:

Thermal control systems (active and passive)

Environmental Control and life support and habitability systems

Space suit and crew survival systems

Environmental Control and Life Support (ECLS) encompasses the process technologies and equipment necessary to provide and maintain a livable environment within the pressurized cabin of crewed spacecraft and to support associated human systems such as Extra Vehicular Activity (EVA). Functional areas of interest to this solicitation include thermal control and ventilation, atmosphere resource management and particulate control, water recovery systems, solid waste management, habitation systems, environmental monitoring and fire protection systems. Technologies must be directed at Lunar transit and surface missions, including such vehicles as Lunar landers, surface habitats and pressurized rovers.

Thermal Control Systems - Future spacecraft will require more sophisticated thermal control systems that can dissipate or reject greater heat loads at higher input heat fluxes while using fewer of the limited spacecraft mass, volume and power resources. The thermal control system designs also must accommodate the harsh thermal environments associated with these missions. Modular, reconfigurable designs could limit the number of required spares. Innovative thermal management components and systems are needed to accomplish the rejection of waste heat during these future missions. Advances are sought in the general areas of radiators, thermal control loops, thermal system equipment, and EVA thermal control.

Future space systems may generate waste heat in excess of 10 kW which could either be rejected or redirected to areas which require it. Novel thermal bus systems which can collect, transport (over a distance of ~30 meters), and provide heat for components are sought. The system should be highly flexible and adaptable to changes in equipment locations. Possible systems include single and two-phase pumped fluid loops, capillary-based loops, and heat pumps. Innovative design of the loops and components is needed.

Space suit and crew survival systems are necessary for the successful support of the International Space Station (ISS) beyond 2020 and future human space exploration missions. Advanced EVA systems include the space suit pressure garment, the Portable Life support System (PLSS), Avionics and Displays, and EVA Integration Systems. Future human space exploration missions will require innovative approaches for maximizing human productivity and for providing the capability to perform useful tasks, such as assembling and servicing large in-space systems and exploring surfaces of the Moon, Mars, and small bodies. Top level requirements include reduction of system weight and volume, low or non-consuming systems, increased hardware reliability, durability, operating life, increased human comfort, and less restrictive work performance in the space environment.

Key Words:

Environmental Control and Life Support (ECLS):

Atmospheric resource management, Particulate matter removal and disposal, water processing and waste management systems (water reclamation, water management, clothing systems)

Thermal Control Systems:

Radiators, thermal control loops and equipment, variable emissivity coatings, clever working fluid selection, condensing heat exchanger, heat pumps

Space suit and crew survival systems:

Space suit pressure garment, puncture protection, self-sealing materials, flexible thermal insulation, low venting or non-venting portable life support system, innovative garments for crew member cooling, heat rejection, removal of expired water vapor and CO2, high reliability water pumps and fans.

Other Scientists involved:

Daniel Barta daniel.j.barta@nasa.gov **281 244-5118**
David Westheimer david.t.westheimer@nasa.gov **281 483-2804**
Ryan Stephan ryan.a.stephan@nasa.gov **281 483-7182**
Robert Trevino robert.c.trevino@nasa.gov **281 483-2597**

Proposed Research and Evaluation Criteria

Upon submission, UNCFSP will screen all proposals to ensure that eligibility requirements have been met, that the research areas fall within the NASA-related areas of interest, and that the cluster has developed a relationship with one of the chosen NASA Centers. Proposals not meeting any of these requirements will be considered *not responsive* and will not receive further consideration.

Eligible proposals will be evaluated on the basis of merit by a panel of peer reviewers that includes appropriate minority institution faculty with demonstrated expertise in science, technology, engineering, and mathematics, private industry professionals and NASA personnel. The Peer Review Panel will review and evaluate the proposals based on the selection criteria below. Further consideration is given to: (a) technical merit of the proposed research; (b) the relevance of the proposed research to NASA's objectives as outlined above; and (c) technical capabilities of the research team. The panel will make award recommendations to UNCFSP. Based on these recommendations, NASA and UNCFSP will determine and fund eligible institutions. Please create a proposal that will clearly explain your research.

Abstract OR Executive Summary: Limit to one (1) page.

Proposal: Limit to 10 pages. The proposal should:

1. Clearly explain the project objectives

2. Clearly define the roles and responsibilities of the PI and the students
3. Describe the methods that will be used to conduct research
4. Provide timelines for the project
5. List the anticipated outcomes and benefits of participation
6. Clearly describe how you will evaluate and measure the success of your research including milestones and accomplishments.
7. Include an itemized budget and clear budget justification.

Conclusion: Please limit your proposal summary to one (1) page. The total length of the proposal should not exceed twenty (20) pages.

General Instructions

- When preparing your application use clear concise English. Terms not universally known should be spelled out with the appropriate abbreviation in parentheses the first time it is used. The abbreviation may be used from that point forward.
- Print the application single-sided and single-spaced.
- The text font should be Arial (10 or 12 pt.). Font size for headings should be 14 pt. or 16 pt.
- Margins should be set to one inch (1") on all sides.
- The font color should be black.
- Please ensure that all graphs, charts, photographs, etc. are clearly photocopied.
- Do not attach additional documents.

Application Evaluation Criteria

The Peer Review Panel will use all available relevant information such as the NSTI general application, curriculum vitae, the proposed plan of research, institution certification and PI certification to determine if this applicant should receive an award. Applicants are evaluated in relation to the essential criteria outlined below. Points are assigned for each criterion up to the total amount allowable for that criterion. Awards will be made to applicants who attain the highest score out of a maximum of **100 points**. Experienced reviewers will analyze and rate each application using the following criteria:

Criteria	Points (Awarded)
Qualifications of the PI	15
Quality of Proposal	35

Evaluation Plan	10
Relevance to NASA	10
Institution Certification: Statement of Support	10
Endorsement Letter from NASA Center	10
Budget	10

Applicant Ability, Experience, & Training

Applicants are evaluated based upon their current research interests, publications, presentations, academic training, work history, and achievements (awards, fellowships, scholarships, etc.).

- Does the applicant possess or can the applicant easily obtain the skills required to meet their objectives?

Proposed Plan of Research

The research plan is evaluated based upon the clarity of the research objectives, originality of the project, and/or the feasibility of the approach. Can the objectives reasonably be completed? Are the institutional resources, facilities, equipment, etc. adequate to support the applicant's proposal?

- Project Description

  Reviewers rate the originality of the proposed project. Does the applicant clearly define subject of study, problem, or issue? Does the proposal present a convincing case for the significance of the activity? Does the project lie within the scope of the NSTI?

- Methods/Procedures

  Reviewers rate the feasibility of the approach. Does the applicant present an appropriate method of carrying out the project plan?

- Research Objectives

  Reviewers rate the clarity of the research objectives. Can the objectives reasonably be completed during the grant period?

- Facilities

  Are the institutional resources, facilities, equipment, etc. adequate to support the applicant's proposal?

Budget

Proposers are advised to provide sufficient budget justification and data to allow the peer review to appropriately evaluate the cost realism, reasonableness and acceptability of the proposed effort. The proposal should contain sufficient cost detail and supporting information to facilitate a speedy evaluation and award.

Benefits of Participation

Based upon all the relevant and available information, reviewers rate the value of the potential accomplishments to:

- NASA
- Minority Institution
- Middle School Outreach

Letters of Endorsement

The degree to which the letter supports the applicant's proposal are also evaluated. Does the letter speak to the appropriateness of the proposal and/or qualifications of the applicant to meet the objectives? Does the applicant have the level of support from the NASA Center to contribute to project success?

- 1 Endorsement Letter from the proposed NASA Center Point of Contact

Application Check List

Included	REQUIREMENT *(Pages Limit)*	Maximum Page(s) Allowance
	Executive Summary	2
	Curriculum Vitae	10
	Proposed Plan of Research	20
	Endorsement *NASA Center Point of Contact*	1-2
	Institution Eligibility Form	2
	PI Eligibility Form	2
	Institution Capability	2

Technical Assistance

UNCFSP will provide a Policy and Procedures Guide to awarded institutions. In addition a report template for data tracking will be forwarded to each institution. UNCFSP project personnel will also be available to answer questions and provide guidance. Research faculty, undergraduate and

graduate students will be required to attend several professional development activities as a part of the award.

Performance Requirements

Awards that will continue beyond the first year are contingent not only upon the annual demonstration of satisfactory progress but also the availability of funds. Successful performance must be demonstrated through:

1. Submission of detailed quarterly reports for review by UNCFSP. These reports will (1) describe major cluster activities over the preceding three months; (2) describe the extent to which project goals are being attained; (3) identify major challenges and problems and explain how they are being addressed; and include a complete budget. UNCFSP will strongly encourage grantees to submit reports that include both quantitative and qualitative data. Detailed reporting formats and guidelines will be made available to grantee institutions.
2. Submission of detailed annual reports for review by UNCFSP. These annual reports are submitted in place of fourth quarterly reports. Although they are similar to quarterly reports in structure, requiring a description of major grant activities, cumulative data, measurable outcomes, as well as challenges and problems, the annual report addresses the preceding twelve months.
3. Submission of Office of Education Performance Measurement (OEPM) data and/or Annual Performance Goals (APGs) to NASA. NASA Education collects program education data from activities and reports program results. Proposals funded under this announcement will be expected to contribute to NASA's measurements for education. NASA's current measures and plans can be found at www.Expectmore.gov.
4. Submission of a detailed final report to UNCFSP that describes project activities and the extent to which the project has attained its goals. Institutions will also be encouraged to seek additional funding to continue the research. Detailed reporting formats and guidelines will be made available to grantees institutions.
5. Submission of other reports as may be required by UNCFSP, based on needs and requirements of the NSTI Program and/or NASA.
6. Attendance by the research faculty, undergraduate and graduate students at the annual NSTI meeting. By bringing institutions together to present their NSTI project and

outcomes, UNCFSP hopes to provide everyone an opportunity to learn about other areas of research, engage in professional development workshops, and discuss planned, future and additional collaborations.

Timeline of Activities

DATES	PROGRAM ACTIVITY
February 14, 2011	ANNOUNCEMENT OF NSTI REQUEST FOR PROPOSAL
April 1, 2011	PROPOSAL SUBMISSION DEADLINE
May 1, 2011	ANNOUNCEMENT OF NSTI AWARDEES
May 17, 2011	SUB-GRANT AGREEMENTS SENT TO GRANTEE INSTITUTIONS FOR SIGNATURES
May 23, 2011	GRANTEES RETURN SUB-GRANTS BACK TO UNCFSP WITH SIGNATURES
June 1, 2011	RESEARCH BEGIN
October 15, 2011	FIRST QUARTERLY REPORT DUE (ONLINE SURVEY)
June – November	MID-SEMESTER PROFESSIONAL DEVELOPMENT
January 15, 2011	MIDYEAR REPORT
March 15, 2012	THIRD QUARTERLY REPORT DUE (ONLINE SURVEY)
January – March	MID-SEMESTER PROFESSIONAL DEVELOPMENT
June 30, 2012	YEAR END REPORT DUE
To be announced	OEPM REPORT/ANNUAL PERFORMANCE GOALS

APPENDIX

PROPOSAL

NASA Science and Technology Institute (NSTI)

Submitted by:_____

Name of Institution

_____

Name of NASA Center

_____

Name of Proposal

Institution Eligibility and Certification:

Institution: _____

Institutional Official:_____

This person must have authority to commit or receive funds on behalf of the Institution. (AOR)

Title: _____

Address:_____

City: _____ **State:** _____ **Zip:** _____

Telephone: _____ **Fax:** _____ **Email:** _____

Statement of Institution Eligibility:

Principal Investigator Eligibility:*

Principal Investigator_____

Title:_____

Address: _____

City: _____ **State:** _____ **Zip:** _____

Telephone: _____ **Fax:** _____ **Email:** _____

***Add second sheet(s) for Co-Principal Investigator(s)**

Eligibility of Principal Investigator (brief description of what makes them appropriate to head up the project for the institution):